

STATE OF WAPA's ASSETS

WINTER
2022

WESTERN AREA POWER ADMINISTRATION





LETTER FROM THE ADMINISTRATOR AND CEO

Throughout the past decade, WAPA has worked steadily to build the foundations and culture to become a data-driven organization that responsibly owns, constructs, maintains, operates and invests in the multi-billion-dollar asset base entrusted to our care.

The organizational North Star of our Asset Management team is to maximize the value of our assets, utilize risk-based methodologies to strategically inform capital investments and quantify the potential consequences of not doing so. A few years ago, AM also began to assess the correlation between asset risk and transmission resilience.

In today's era of elevated market volatility, this focus on resilience could not be more prescient and will inform both the challenges and opportunities that lie ahead.

Overall, the strategy we have employed protects WAPA's most important physical equipment and systems, including cybersecurity, by identifying and mitigating risk associated with those assets. AM combines the extensive field knowledge of our staff with data and risk analysis of maintenance activity, capital program planning and financial decision making to lengthen the service life and improve the return on investment of WAPA's assets.

WAPA has always kept reliability top of mind. A few years ago, we even added a core value that states, "Serve like your lights depend on it." We seek to prevent, minimize and respond swiftly to disruptions from natural, physical and cyber threats, and ensure services are restored quickly when disruptions occur.

WAPA's proactive and swift response stance has been tested by a variety of high-visibility extreme weather events in the past year, ranging from storm response to historic wildfires. Our leaders across the enterprise rose to the occasion to protect assets and communities by successfully partnering with customers to minimize financial and operational risk.

In 2021, we kicked off a Workload Management Initiative to pair our equipment data with our staffing and organizational priorities. This initiative continues into 2022. Managing finite resources in the face of ever-present infrastructure aging, ambitious regional 10-year capital plans, routine maintenance work and work for others is a challenge in the best of times. Incorporating

emerging factors – such as increasingly extreme weather impacts, inflation and supply chain pressures, an ongoing pandemic and a historic push for new and expanded energy infrastructure – into our planning and management of resources will be key to our collective success.

If there is one takeaway from the past two years of the pandemic, it is this: People are truly our greatest resource. Our people are where each initiative, program, project, achievement and lesson learned begins. They are the foundation of everything we do. WAPA's project management professionals are critical to our success, as is the unparalleled field knowledge of our outstanding and innovative Maintenance employees.

This year, my top priority is charting a clear path forward that transcends the incredible progress we have made in recent years in the areas of asset planning and management; lifecycle management; and workload management. We will continue to mature these important internal disciplines while increasing our incorporation of meaningful information and data into our decision-making processes.

Effectively managing our investments requires extensive use of equipment data, field knowledge and risk-based analysis to identify the most effective use of customer and other funding. This is what we do.

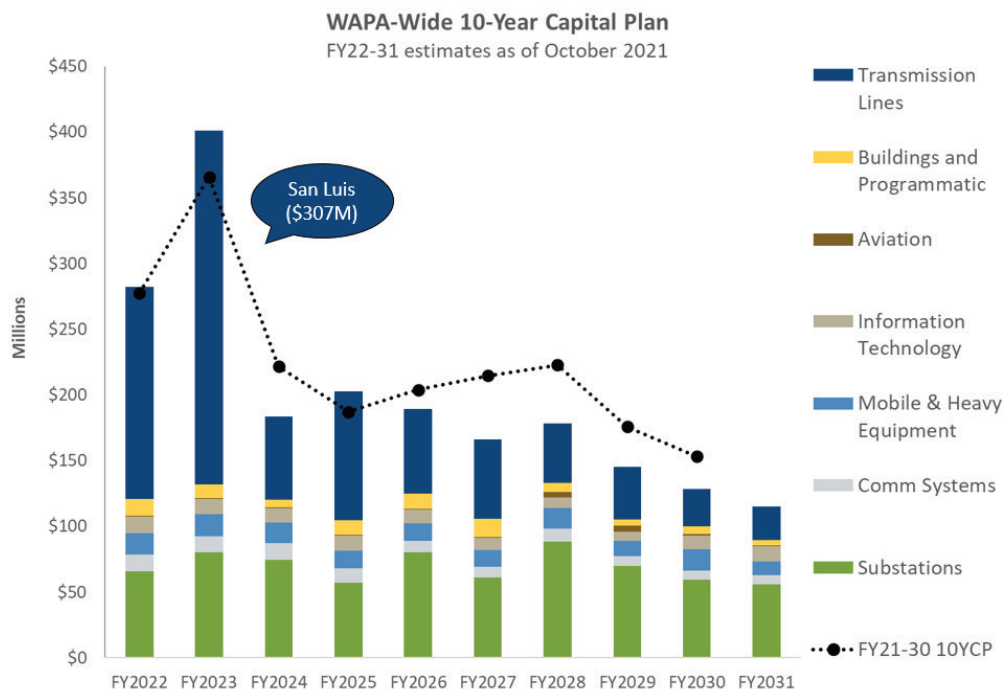
Comprehensive, illustrative and meaningful information – synthesized from mountains of data points – leads to discovery of new applications for making well-informed decisions. Forecasting and budgeting Operations and Maintenance ensures assets are well-maintained and informs the optimal replacement time. This is crucial to ensuring safety and reliability. Data is also a powerful tool for managing project and maintenance schedules, thereby increasing efficiency of crews and engineers.

We are resolved to continue the maturation of AM and our other programs across WAPA. As a learning organization, we will continue to identify opportunities for improvement and discover meaningful insights that will help us and our assets remain reliable, resilient and viable on an ongoing basis. That is our charge.

A handwritten signature in blue ink, consisting of a stylized, cursive 'W' followed by a long horizontal line.

State of Operations

WAPA operates a distributed business model with various functions spread throughout its 15-state, 1.4-million-square-mile territory. Located in Lakewood, Colorado, WAPA's Headquarters serves many diverse stakeholders, including Congress, Native American power customers, public power utilities, other government agencies and WAPA's regional and field offices.



HQ is home base for WAPA's administrator and CEO, General Counsel, Economic Impact and Diversity, Public Affairs, Operations, Finance, Safety, Physical Security, Asset Management, Information Technology and other offices.

Within these functions, WAPA accomplishes the "behind-the-scenes" work to fulfill the needs of around 700 firm electric service utility customers, who then provide electricity to more than 40 million people throughout the West. This work includes:

- Representing WAPA in Washington, D.C.
- Conducting public meetings.
- Developing publications such as the annual report.
- Managing finances and WAPA's annual budget.
- Focusing support on WAPA-wide employee safety and system security.
- Designing and maintaining power systems facilities.
- Emergency management.
- Overseeing and continuously improving North American Electric Reliability Corporation compliance activities.
- Supporting renewable resources and environmental protection.
- Providing helicopter services to all WAPA service areas and supervising unmanned aerial system integration.
- Supporting the power marketing community.

The Asset Management program was initially launched in 2015 in support of a more strategic approach to WAPA's capital planning efforts and the development of regional 10-year plans.

The primary near-term focus areas for AM include:

- Better utilization and visualization of existing asset data.
- Leveraging the use of data to make risk-based asset replacement decisions in the face of challenging hydrological conditions.
- Development of labor forecast models to better understand the integration of budget and program execution.
- More stable and accurate asset inspection platforms.
- Improved use of historical asset maintenance records to inform future asset maintenance procedures.

As AM strategically moves from traditional spreadsheets to new, user-friendly data visualization platforms, capital planners and Maintenance personnel will be able to manipulate the ways in which the data is displayed, increasing its value to the decisions they are making. Sorting data by region, Maintenance office and field location will be a simpler and more straightforward process.

A key tenet of AM is the consequence analysis approach to risk-based management of assets. Simply put, understanding the consequence a failed asset has on WAPA's ability to deliver power allows Maintenance to make calculated decisions regarding which assets to maintain, which to replace and which to leave as they are. With each of these options comes a level of financial investment on behalf of WAPA and, more importantly, WAPA's customers. As drought conditions worsen in the West, financial implications of capital investments are more critical than ever.

Accurately developing resource-loaded project schedules and predictive labor models for traditional maintenance and construction projects continues to be a priority. Ensuring accurate schedules and forecasts improves WAPA's ability to execute on allocated annual budgets. Improved forecasting models use historical data provided by AM on asset-specific maintenance work orders and develop a forward-looking labor forecast that has not previously been available. The more detailed forecast includes items such as substation size, travel time, duration of work on specific asset types and operational inflexibilities. These items, which are now included in the forecasting model, provide keen insight into a once-generic estimate.

As mobile technology and software systems continue to evolve, so does WAPA's approach to routine inspections of the transmission system. Accurately and efficiently capturing the first-hand knowledge of electricians and linemen using mobile tablets is an effective way to capture asset-specific health data that is easily uploaded to databases for use by data consumers and decision makers.

For several years, WAPA has been capturing asset failure modes, which identify a categorical reason that an asset failed and the type of work needed to get the asset back into service. Using this historical information, WAPA is better positioned to adjust asset maintenance schedules and procedures as necessary.

WAPA's North American Electric Reliability Corporation Reliability Compliance program is continuing to standardize and automate key compliance processes for the program itself and the programs being monitored.

In 2021, WAPA participated in remote Western Electricity Coordinating Council and Midwest Reliability Organization audits for the Sierra Nevada and Rocky Mountain regions, adopting process changes that improved the efficiency, quality and effectiveness of the activities. The NERC Reliability Compliance program will continue to actively participate in several industry groups, such as the North American Transmission Forum, WECC and NERC to exchange and implement best practices for upcoming standards. Additionally, the program is involved in internal

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WAPA projects for facilities ratings, records management, new IT systems, markets and information protection.

As a result of WAPA's workload planning initiative, Engineering and Design is continuing the Engineering Ticket System project, which will document all incoming design requests, provide workload visibility and standardize request workflow. Engineering and Design has partnered with the Maximo development team to accomplish the project's vision.

The first component of the Engineering Ticket System was launched in summer 2021 and consists of a standardized Engineering Design Request form. High-level tracking for each request is also available. The next phase is currently in development, scheduled to launch in early 2022. It will provide greater management of a request's lifecycle, assign staff resources and track schedules. Future phases will focus on utilizing the data that will be collected in Maximo for reporting and provide transparency of Engineering and Design workload.

WAPA's Electric Power Research Institute and Power Systems Engineering Research Center memberships provide benefit to the organization through use of their information, technology and products. These memberships benefit WAPA personnel in terms of research results and tools.

The organization's staff also participates in meetings and research activities and act as industry advisors with the programs to which WAPA subscribes. Membership

and participation enables staff to implement tools and technologies that impact the industry and stay abreast of changes.

During 2022, the Strategy Office's top priority is the development of WAPA's 2030 strategic plan, which will reset the guiding framework for meeting WAPA's mission and support its ability to address current and emerging issues head on.

Integrating the results of an environmental scan, customer and employee feedback and stakeholder input, Strategy will work with senior leaders to identify the organization's strategic priorities, key organizational results and strategic objectives. Strategy will also partner with internal leadership councils and functional areas to cascade strategic goals to all levels of the organization.

Other major initiatives include supporting WAPA's transition to a hybrid work environment by identifying and piloting best practices to build and support a strong culture while ensuring mission accomplishment and supporting employee flexibility. Strategy will also continue to infuse continuous process improvement into WAPA's culture to support organizational efficiencies and effectiveness and achieve cost savings, as well as advance the strategic use of key performance data and other data for decision making.

In conjunction with Strategy, the Office of Security and Emergency Management conducted a Security Cultural Survey. The results will be shared with senior leaders and employees in 2022 with the objective of identifying gaps

for future improvement.

Also in 2022, OSEM will conduct nine Physical Security Risk Assessments on WAPA substations and facilities. OSEM is conducting PSRAs with its own personnel, cancelling a \$1 million contract for outside support. Additionally, WAPA Order 470.1, Safeguards and Security Program, is being rewritten to capture enhancements in security processes and procedures.

The Human Performance Improvement and Just Culture Program continues to gain momentum. In March 2021, the program ran a WAPA-wide survey that had 278 participants. The responses were used as a baseline to guide initial activity for the program.

The program also finalized the Power System Human Performance Metric Guide, retiring the former Accountable Outages criteria. The guide will ensure consistency across WAPA and align with industry best practices. Event Analysis Teams were formed in each of the regions, tasked with sufficiently evaluating power system incidents to identify recommended corrective actions that prevent reoccurrence and share them across the organization. This supports the Principles of Excellence from the NATF to capture, share and learn from operating experiences.

The Office of the Chief Financial Officer directs Finance department activities, including the planning, execution, reporting and auditing of WAPA's financial affairs. The OCFO's goals for fiscal year 2022 include securing a sustainable funding source for WAPA's Purchase Power and Wheeling program, migrating WAPA's budget formulation system from on-premises servers to the cloud and implementing a G-Invoicing system to process transactions between federal agencies. This is a mandate from the Department of the Treasury that must be in place by Oct. 1.

The OCFO will also fully implement Robotic Process Automation to process Accounts Payable invoices. This will allow WAPA to process 2,500 or more invoices per year, which will free up staff to focus on other important tasks. Staff will also work with the Department of Energy, the Office of Management and Budget, Treasury and the other Power Marketing Administrations to enhance the federal appropriated debt reporting model.

Safety and Occupational Health oversees the wellbeing of more than 1,500 personnel working in a wide variety of

settings and locations. The Headquarters SOH office works closely with Safety managers and specialists in each region, monitoring and responding to issues while implementing controls to reduce workplace hazards.

These efforts are measured annually through recordable safety incidents at WAPA, which have decreased by 69% over the past four years. During 2021, WAPA achieved its lowest Recordable Incident Rate in 44 years of operation. This incident rate of 0.3 is substantially less than the Bureau of Labor Statistics rate of 1.7 for the Electric Power Transmission, Control and Distribution industry. SOH looks forward to continuing this trend through a variety of activities as it strives toward a zero-incident workplace.

SOH will continue to promote employee engagement, information sharing and communication through the production of Learning Summaries, Near-Miss Reports, a bimonthly newsletter and monthly articles in *Closed Circuit*. SOH will also continue to develop key existing and newly established relationships with management and employees through interpersonal communication related to group training, field visits, site monitoring, online meetings and team-building activities. These activities will strengthen trust over time with WAPA personnel, while also promoting innovation, new ideas, better decision making, reduction of errors, fewer safety incidents and a stronger safety culture.

To help address safety communication issues and challenges, SOH will introduce the "Report a Safety Concern" page, which will enable employees to report concerns easily and get direct Safety manager follow-up and corrective actions in a timely manner.

SOH will continue to work closely with external partners, including RMEL and the NATF, keeping up to date with the challenges, issues and topics facing the industry. WAPA will also remain an active member of the American Society of Safety Professionals, American National Standards Institute and the National Safety Council.

As WAPA continues to navigate the COVID-19 pandemic, SOH will provide consultation and support for personnel at all levels to help them successfully meet the unique health and safety challenges facing field, maintenance, construction and facility operations.

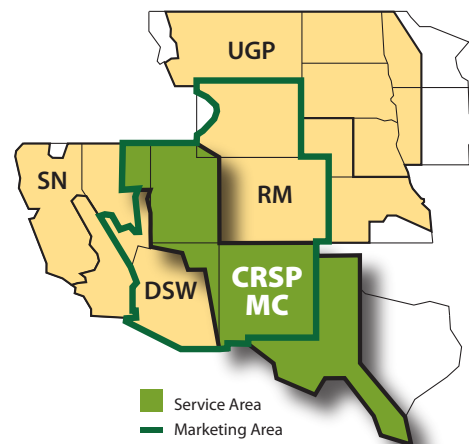
State of the Regions

COLORADO RIVER STORAGE PROJECT MANAGEMENT CENTER

The Colorado River Storage Project Management Center markets clean, reliable hydropower from 11 powerplants under a single rate known as the Salt Lake City Area/Integrated Projects. These generating resources produced an average of 5,059 gigawatt-hours annually over the past 10 years for CRSP MC's 130 preference and project-use customers.

Glen Canyon Dam is the largest powerplant, generating 74% of SLCA/IP energy. Transmission facilities in Arizona, New Mexico, Colorado, Utah and Wyoming deliver SLCA/IP hydropower to preference and project-use customers. CRSP MC owns 2,316 miles of transmission lines and 42 transformers.

In the area of power marketing, CRSP MC continued to work toward refining and operating within the new Western Energy Imbalance Service market offered by Southwest Power Pool. Continual coordination within internal groups, as well as continued education and refinement with the SPP market monitoring group, was a priority to ensure that CRSP MC continued to provide the same valuable service to the Loveland Area Projects and CRSP



customers, while also efficiently operating in a new market.

CRSP MC is evaluating entry into the SPP Regional Transmission Organization and assessing its ability to operate fully while managing many other challenges, such as continued drought and financial impacts to the Basin Fund. CRSP MC staff engages in SPP meetings, both internal and external, to ensure that customers' interests and the use of the transmission system are fully considered in the new RTO footprint.

The Rates team continued to collaborate and gather input from customers and other stakeholders and established a new firm electric service rate to mitigate the high purchase power costs and decreasing generation driven by the drought in the western U.S. In the new rate that became effective Dec. 1, 2021, CRSP MC reduced firm electric sales to match generation on a quarterly basis and offered to purchase power up to the customers' allocated contractual

amount on a pass-through basis. The new rate increased the firm power composite rate from 27.45 to 30.51 mills per kilowatt-hour.

Staff members continued reaching out to customers who have not yet signed the 2025 SLCA/IP power contracts, which become effective Oct. 1, 2024. The contracts extended customers' services under the current marketing plan through 2057.

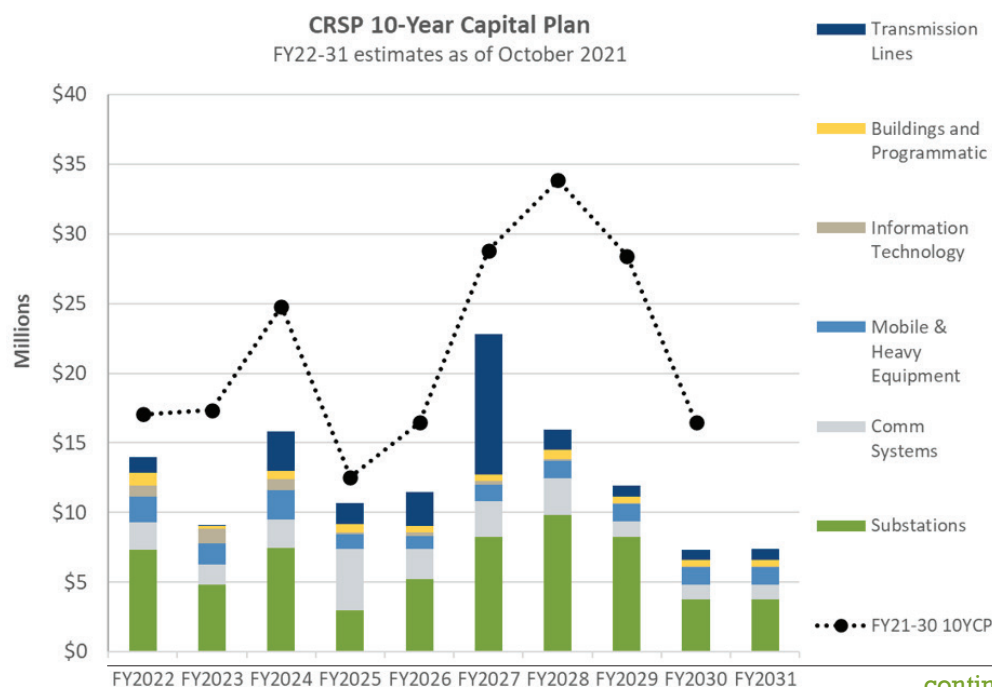
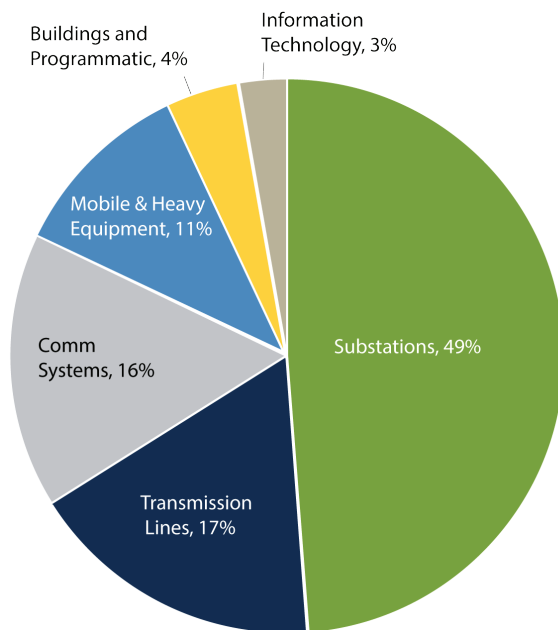
CRSP MC's Tribal outreach continues to strive to find and provide additional benefits to 53 Native American Tribal customers. Since the SLCA/IP allocations were awarded in 2004, three Tribal utilities have been established. Several

other Tribes are considering establishing their own utilities. In 2021, CRSP MC continued to reach out to Tribal leaders to strengthen working relationships, even with the limitations of the pandemic.

Maintaining infrastructure in partnerships with other WAPA regions and the Bureau of Reclamation is a high priority for CRSP MC. In 2021, completed projects included rerouting a segment of the Flaming Gorge-to-Vernal Line #3, adding optical ground wire between the Upper and Lower Molina plants, replacing disconnect switches at Ault Substation, replacing a Mingus Mountain communication building, replacing breakers and a shunt capacitor bank at Pinnacle Peak Substation, adding variable reactors at the Kayenta and Long House Valley substations and completing rehabilitation of the Glen Canyon Warehouse for joint use by WAPA and Reclamation.

Various projects will continue or be completed in 2022, including:

- Pinnacle Peak breaker replacements and station service upgrade.
- Glen Canyon Substation station service replacement.
- Communication upgrades for CRSP South System with microwave upgrades and relay and metering replacements.
- Crystal underground cable replacement.
- Midway Substation transformer replacement.
- Montrose warehouse and machine shop transformer replacements.
- Shiprock Substation breaker replacements.
- Hayden Substation failed reactor replacements.



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Environment staff is proud to play a role in the recovery of endangered fish species in the Colorado River through participation in the Upper Colorado River Endangered Fish Recovery Program and the Glen Canyon Dam Adaptive Management Program.

In 2021, the Fish and Wildlife Service issued a final rule to downlist the federally protected humpback chub from endangered to threatened status due to increasing populations, and issued a proposed rule to downlist the razorback sucker. Changing the fishes' status from endangered to threatened should allow more flexibility in the hydropower facility operations in the Colorado River drainage basin.

In the Upper Colorado River Basin, CRSP MC staff is conducting a hydropower analysis on an Endangered Species Recovery Program Report that recommends flow and temperature experiments in the Green River below Flaming Gorge Dam. WAPA's biologists are collaborating with Reclamation and the FWS Endangered Fish Recovery Program Office to analyze how experimental flow recommendations influence hydropower resources.

Experimental flow releases being evaluated include spring peak water releases timed to match larval razorback sucker abundance and enhance backwater rearing habitat inundation; spike flows in late spring or early summer to disrupt smallmouth bass spawning; and elevated base summer flows to support spawning and rearing habitat for juvenile Colorado pikeminnow. In 2021, CRSP MC implemented the first test of the spike flows.

Biologists helped coordinate and conduct biannual trout surveys for the popular sport fishery below Flaming Gorge Dam. The trout survey helps determine the population status as it relates to dam operations and environmental conditions. This work has shown that trout populations are strong and that the double peaking of water releases, which is especially desirable for power operations in the winter, is also beneficial to trout populations.

Environment employees are assisting the Grand Canyon Monitoring and Research Center with studies evaluating the effects of Glen Canyon Dam operations on downstream resources. One such study, the "bug flow" experiment, evaluated how changes in water releases affect the insect population that supplies food for the rainbow trout below the dam. Due to the ongoing drought, the experiment was not implemented in 2021, and scientists have been working on a synthesis of information gained to determine future experiments in 2022.

Of critical importance to the Environment team is the extended drought throughout the entire Colorado River Basin. Reservoir elevations at Lake Powell have dropped to critical levels and are expected to drop below 3,525 feet in February, prompting additional responses from WAPA and Reclamation. Reclamation is working with the Basin states and WAPA to develop a plan to try to keep Lake Powell above minimum levels. Dropping lake levels and additional Upper Basin releases have resulted in numerous important biological issues regarding temperatures, flows and protection of native fish and other species. CRSP MC expects this to be a major influence on activities.

CRSP MC is collaborating with Dr. Larry Stevens on an aquatic project that complements the Integrated Food-base Study being performed by Utah State University and the GCMRC, which has been primarily focused on determining the effects of flow fluctuations on macroinvertebrate egg mortality and whether this is a primary cause for low diversity and production of macroinvertebrates in the Glen Canyon tailwaters. This project, beginning its second year, expands the investigation to include the effects of Glen Canyon Dam operations in terms of daily flow fluctuations, as well as environmental factors such as ecological succession, nutrient dynamics and temperature impacts on epiphyte, macrophyte and aquatic macroinvertebrate diversity and production. This study will help assess which operations do or do not impact trout and invertebrate production below the dam.



DESERT SOUTHWEST

Desert Southwest markets hydroelectric power to about 100 municipalities, cooperatives, Native American Tribes, federal and state agencies and irrigation districts in Arizona, California and Nevada from powerplants operated at Hoover, Parker and Davis dams. DSW maintains 67 substations, 2,689 miles of transmission lines ranging from 34.5-kilovolts to 500-kV and 80 communication sites to provide safe, secure, reliable and affordable energy and transmission services to its customers and communities.

At the start of this fiscal year, DSW already completed the bypass of the mothballed Navajo Generating Station in Arizona and the emergency replacement of two 230-kilovolt oil breakers at Prescott Substation.

One major ongoing project that will continue in 2022 is the Vail-to-Tortolita transmission line rebuild. This is a joint project with Tucson Electric Power to upgrade WAPA's

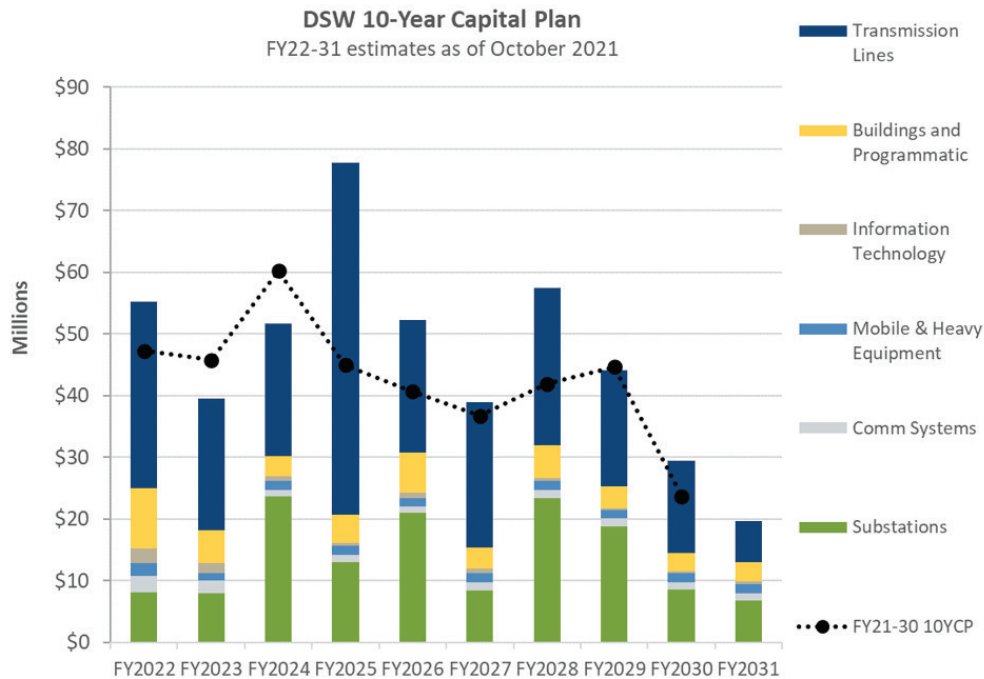


existing infrastructure along a 64-mile stretch in Arizona between TEP's Vail Substation, located in Pima County, and its Tortolita Substation, located in Pinal County.

The project will replace an existing 115-kV WAPA transmission line with a double-circuit 230-kV transmission line. One circuit owned by TEP will be installed between TEP's Vail and Tortolita substations, with a slight detour to DeMoss-Petrie. The other circuit, owned by WAPA, will be installed between structures on the Electrical District 5-to-Rattlesnake, Nogales-to-Adams and Adams-to-Apache 115-kV transmission lines

With the exception of Nogales, both circuits will be tied to

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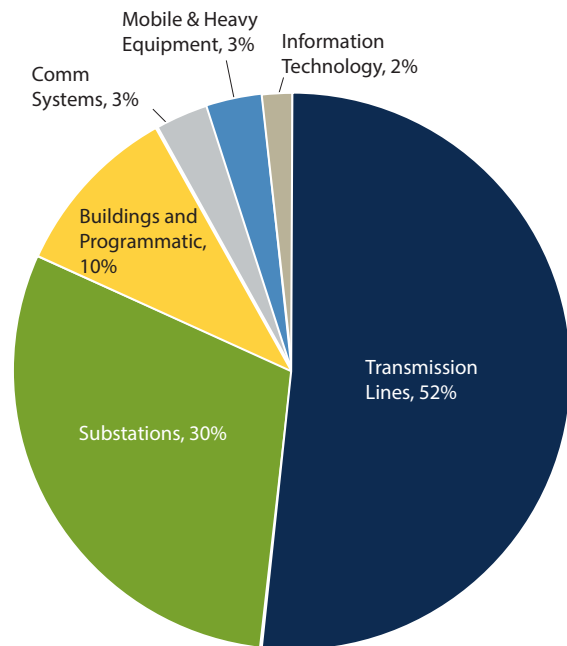
takeoff structures outside of each substation and switchyard along the route. Included substations and switchyards are Tortolita, Rattlesnake, Tucson, Del Bac, DeMoss-Petrie and Vail. Nogales will be bypassed.

The project calls for the installation of approximately 500 steel monopoles to replace H-frame wood pole structures that are more than 50 years old. The Bouse-to-KOFA transmission line will also experience a rebuild.

Other major projects DSW has planned for 2022 include:

- Continuing the rebuild of the Blythe-to-Knob transmission line. This year will involve the replacement of structures within the mountain range.
- Managing vegetation and mitigating right-of-way issues along the Electrical District No. 5-to-Tucson transmission line to allow crews to repair and replace structures.
- Replacing and rebuilding breakers at Electrical District No. 2, Glen Canyon, Liberty and Pinnacle Peak substations.
- Conducting and closing out station service replacements at Coolidge, Glen Canyon, Liberty, Parker and Pinnacle Peak substations.
- Performing protection and communication upgrades at Glen Canyon, Liberty, Mead, Pinnacle Peak and Test Track substations.
- Replacing transformers and related equipment at Hoover Dam and Gila Substation.

DSW also has a large number of construction projects planned for this year and beyond.



A rebuild is planned for the Gila Substation 69-kV switchyard, Mead Substation will have its main entrance gate replaced and safety improvements will be implemented at the Yuma Maintenance Facility.

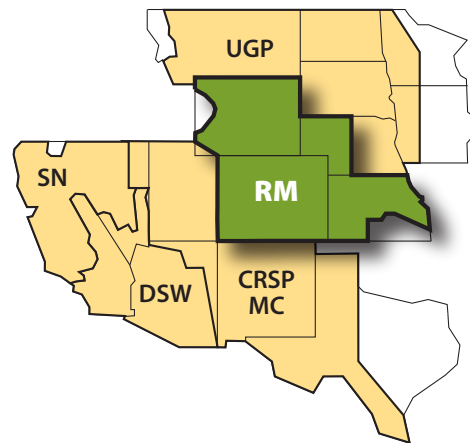
Capacitor bank breaker replacements will be made at Flagstaff and Pinnacle Peak substations, and the Sonora and Wellfield substations will have 12 pad-mount transformers replaced.



ROCKY MOUNTAIN

Rocky Mountain serves around 120 preference customers with Loveland Area Projects allocations in Colorado, Wyoming, Nebraska and Kansas. It markets more than 2.1 million megawatt-hours of power generated at 20 hydroelectric plants in the Loveland Area Projects, through both the Fryingpan-Arkansas Project and the Pick-Sloan Missouri Basin Program—Western Division. RM reliably delivers federal and nonfederal power through 3,366 miles of transmission lines and 84 substations.

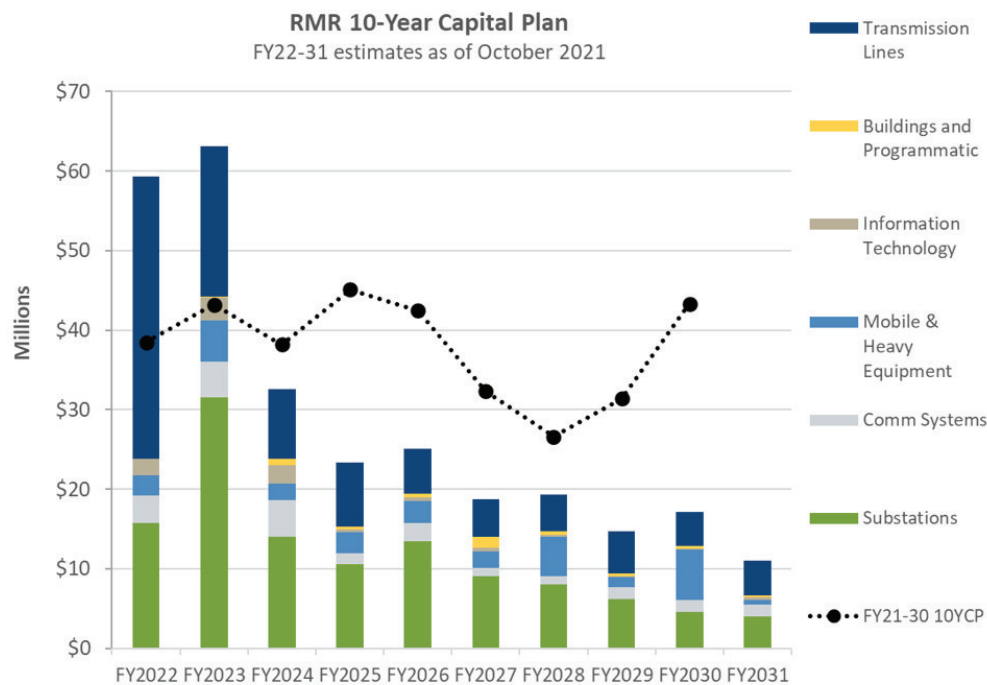
RM and LAP have not yet been significantly impacted by drought conditions. However, drought conditions are beginning to emerge in the North Platte Basin, Bighorn Basin and the headwaters of the Colorado River.



Fiscal year 2021 marked the first time in five years that LAP generation has been below historical average. Overall, strong reservoir storage levels have minimized drought impacts to LAP. RM, in conjunction with Upper Great Plains, is closely monitoring the 2021-2022 snowpack for signs of furthering drought conditions.

LAP rates are expiring at the end of 2022. RM and UGP

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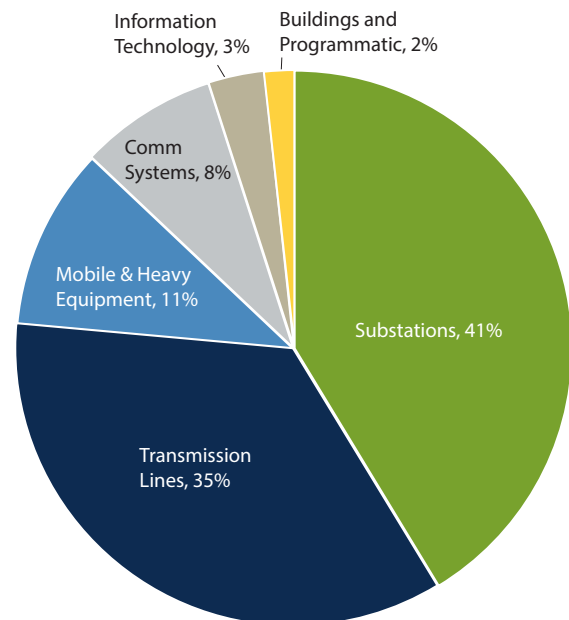


will be kicking off formal rate adjustment processes for LAP and the Pick-Sloan Missouri Basin Program—Eastern Division in 2022. The process will include opportunities for ongoing dialogue with customers regarding the potential impacts of drought and other adverse conditions. RM will work collaboratively with customers to identify solutions to these issues.

WAPA decreased the composite LAP rate by 12% in 2017 and 14% in 2018; WAPA held the LAP rate flat again for 2022, marking 13 consecutive years with a flat or decreasing rate. The current LAP five-year rate expires at the end of 2022, and RM will conduct a rate process in 2022 to establish a new five-year rate to become effective Jan. 1, 2023.

On Feb. 1, 2021, RM and the Western Area Colorado-Missouri Balancing Authority became a market participant of the Southwest Power Pool Western Energy Imbalance Service. To support the WEIS go live date, WAPA finalized its Open Access Transmission Tariff modifications, updated its Business Practices, established modified transmission and ancillary formula rates, executed standardized Balancing Authority Services Agreement contracts, developed Settlements processes and procedures and continued working with the Bureau of Reclamation to install generation metering on Reclamation hydropower generators.

On Sept. 20, RM published a *Federal Register* notice with the allocation procedures and call of applications for the 2025 LAP resource pool. Thirteen potential new customers submitted applications. In the spring of 2022, RM will re-



view the applications, determine new allocations, and offer contracts to customers that meet the eligibility requirements. Service for new customers will begin Oct. 1, 2024, and it will ensure the most widespread use of LAP.

In September 2020, RM was included in a letter of interest sent to SPP to participate in an investigation for potential expansion of the SPP Regional Transmission Organization in the Western Interconnection. On July 27, 2021, the SPP Board of Directors and Strategic Policy Committee ap-

proved the submitted policy-level terms and conditions for RTO expansion in the Western Interconnection.

This major milestone represented a key decision point for the initiative. The Colorado River Storage Project Management Center, UGP-West and RM, along with the other prospective SPP RTO-West participants, are in the process of updating and expanding the market study commissioned by SPP and performed by Brattle Consulting in late 2020.

The new study will include Colorado Springs Utilities, which joined the RTO-West initiative in May 2021, and will evaluate additional hydrology sensitivities from the Bureau of Reclamation's updated projections. Other entities participating in the expanded study include WAPA, Tri-State Generation and Transmission and Basin Electric Power Cooperative.

WAPA expects to receive study results in early 2022 and will consider those results before initiating a public process in a *Federal Register* notice. WAPA believes that it is crucial to fully understand what RTO membership may mean for different regions and customers before making a decision. The target implementation date, assuming continued progress on the initiative, is fall 2024.

On June 18, 2021, Power Operations went live with a new Energy Management System. This effort represented a multiyear collaboration with Information Technology. The project provided Power Operations with increased capabilities within the Phoenix and Loveland control centers and provided IT with a more supportable system.

Power Operations also saw an expansion of renewable generation installs throughout the year. The Western Area Colorado-Missouri Balancing Authority added 609 megawatts of wind generation, with around another 370 MW expected in early 2022. The Western Area Power Administration, Lower Colorado BA added 270 MW of renewable generation throughout 2021 and has 580 MW of new capacity planned for 2023 and beyond. The integration of these renewable sources allows for customers to meet various state and federal policies on carbon-based energy sources while promoting diversity in generation fuel sources.

Vegetation Management executed 31 vegetation management projects throughout 2021. These projects included work on transmission lines such as the Ault-to-Craig 230-kilovolt line, the Craig-to-Rifle 230-kV

line and the Kremmling-to-Windy Gap 138-kV lines in Western Colorado. The team also completed Vegetation Management efforts on the Lovell-to-North Cody 69-kV line, the Buffalo Bill-to-North Cody 69-kV line, the Buffalo Bill-to-Heart Mountain 69-kV line and the Heart Mountain-to-North Cody 69-kV lines. Work was performed on several lines in Eastern Colorado and the Front Range, including the Terry Street-to-Erie 115-kV transmission line.

The Vegetation Management program continues to maintain the transmission line corridors and ensure that they are free from vegetation encroachments. This strategy has proven to be effective and has provided fire mitigation benefits in fire-prone areas throughout the region.

In 2022, RM and WACM will work to bring CSU and United Power load into the WACM BA area and will develop new processes and implement improvements for the WACM Services Business Process.

WAPA is working to further strengthen the RM Compliance program, with an eye toward the North American Electric Reliability Corporation's reliability standard FAC-008-5. RM is updating the cross-functional Facilities Rating Change Control Charter Committee, or FRC3, meetings and is improving the Facility Ratings information-sharing practices across departments and regional maintenance areas.

RM provided key support to the WAPA-wide Facility Rating Process Improvement effort, which saw its first phase completed in summer 2021. Additionally, the FRC3 approved the RM rating of every facility in its FAC-008 listing, successfully closing out the corrective action plan initiated in 2019.

In 2020, RM will implement the revised 10-Year Capital Plan, which replaced the reactive deferred maintenance approach with a proactive, planning-heavy approach. The new approach is intended to mitigate risk and avoid preventable emergencies and outages. RM will continue to communicate the changes with the customers.

The reconductoring of the Dave Johnston Tap-to-Sidney Substation 115-kV line continues with completion anticipated this year, after delays due to supply-chain issues.

The Estes-to-Flatiron and Estes-to-Lyons 115-kV rebuild was delayed for one year to allow for significant cost savings on structure foundations and a revised Procurement process. Construction will begin in Q4 and will be completed in fiscal year 2024.



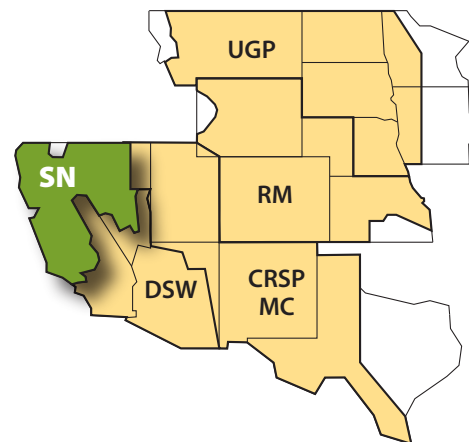
SIERRA NEVADA

Sierra Nevada markets hydroelectric power generated from the Bureau of Reclamation's Central Valley Project to 81 preference power customers in California, including municipal public power utilities, irrigation districts, Native American Tribes, rural electric cooperatives and federal and state entities.

The CVP federal transmission system is owned, operated and maintained safely and reliably by SN and consists of 25 substations, 21 transformers and 1,363 miles of transmission lines. SN is also the operating agent for the 350-mile California-Oregon Transmission Project, one of the three 500-kilovolt lines forming the California-Oregon Intertie.

In 2022, SN staff will continue to work with Reclamation and customers on issues related to the future of CVP hydro-power due to changing market conditions in California.

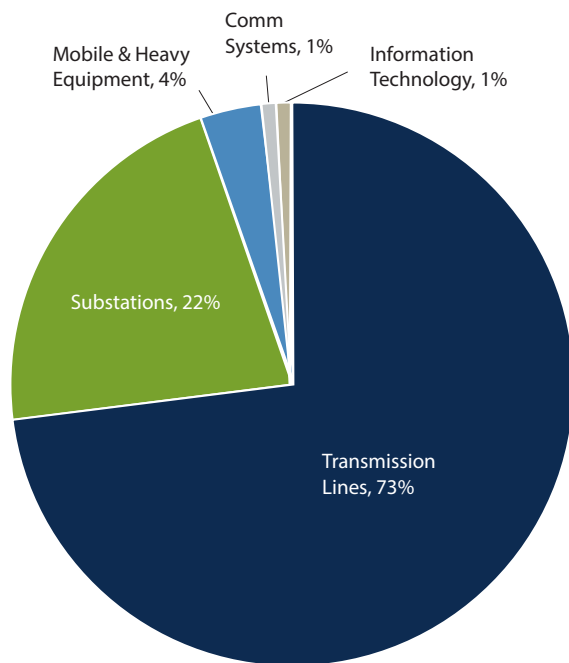
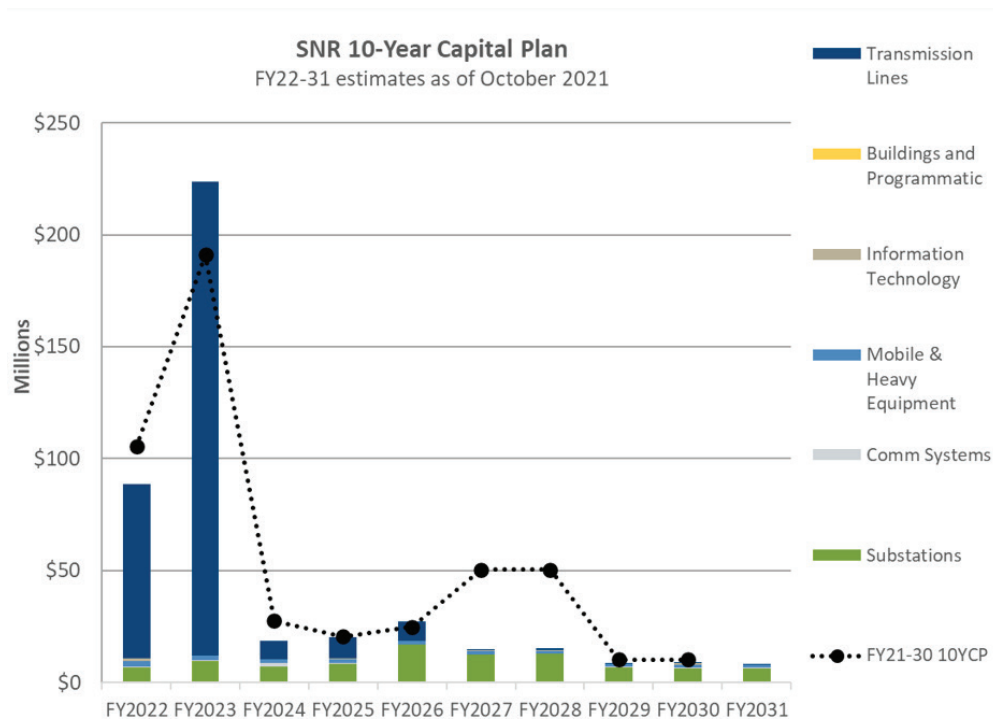
One item that remains open is Reclamation's finalization of the CVP Improvement Act true-up process. In 2020, Reclamation worked with CVP stakeholders to develop Business Practice Guidelines for CVPIA Receipts, Program Accounting, Cost Allocation and Cost Recovery. The



guidelines are still undergoing a federal interagency review and were not finalized in 2021 as initially anticipated.

Reclamation has committed to working with project stakeholders to address concerns raised about the methodology proposed for allocating reimbursable CVPIA costs to water and power customers and the methodology used to apply proportionality to the annual CVPIA assessment.

SN continues to adjust repayment for CVP power customers based on the results of the CVP Final Cost Allocation Study completed by Reclamation in January 2020. The final study results identified a \$32 million reduction in the allocation of capital costs assigned to commercial power for repayment. With the reduction in capital cost assigned to commercial power, SN adjusted the power revenue requirement, or PRR, by \$10 million as a midyear adjust-



ment in 2020, made another \$10 million adjustment in 2021, made an \$8 million adjustment for 2022 and plans to make a final \$4 million adjustment in 2023.

SN will continue to work with Reclamation in 2022 to coordinate a subsequent adjustment to interest charged to power customers on their unpaid capital balances. SN believes that interest on investment should be adjusted

for the same period as the change in the historic allocation of costs, that being 1945-2013. The \$32 million reduced capital obligation identified for power in the CVP Final Cost Allocation Study is partly due to Reclamation's reclassification of costs from reimbursable to non-reimbursable; interest is therefore no longer owed to the Department of the Treasury.

The cumulative historic adjustment to interest is approximately a reduction of \$152.3 million. SN plans to adjust interest expense on the PRR beginning in 2023 with a reduction of \$4 million, and then a \$8 million reduction each year thereafter until the adjustment has been fully applied.

On Sept. 15, 2020, the Pacific Gas & Electric Company filed with the Federal Energy Regulatory Commission proposed rate changes and revisions to certain non-rate terms and conditions of its Wholesale Distribution Tariff Service Agreement with SN. In its filing, PG&E states that its WDT revenue requirement has risen from \$2.7 billion to \$4.4 billion. As a result, PG&E is proposing that utilities interconnect only at the primary level. PG&E proposes to bill certain SN customers that do not have demand meters based on demand, eliminate Reserved Capacity and introduce Contract Demand.

SN filed an Intervention and Protest Oct. 6, 2020, requesting the maximum rate suspension of five months to attempt to settle or litigate the matter. In early 2021,

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several other joint intervenors were able to work alongside FERC staff and PG&E to reach an agreement on a Partial Settlement for Interim Rates that PG&E filed on May 24, 2021. The Interim Rates went into effect June 1, 2021. SN and the rest of the joint intervenors continue settlement proceedings with PG&E on the final Global Rates design.

On March 25, 2021, SN successfully joined the California Independent System Operator Energy Imbalance Market under the Balancing Authority of Northern California. Due to severe drought in California, SN experienced limitations on the amount and frequency of participation in the EIM. SN did experience beneficial dispatches from the EIM market maximizing CVP hydropower generation.

The second-driest two-year period on record was 2020-2021. Low hydrology availability as well as Reclamation's power bypass operations to mitigate environmental issues resulted in adverse financial impacts to SN's power customers.

SN's power rates are insulated from drought costs by its power marketing plan, with the Base Resource product being an as-available product, and custom product purchase costs are passed through to the customers for which purchases are made. Nevertheless, SN continues to work with Reclamation to provide as much value as possible of the CVP to customers by scheduling generation at the high-value hours and allowing for purchases to be made in the low-priced hours.

SN procures power in advance to mitigate the risk of price volatility through its Risk Management Committee processes for long-term power purchase planning. SN and Reclamation meet with customers regularly regarding power and water operations updates and CVP power forecasts so that SN's customers are apprised of the impacts and outlook of the drought conditions.

In 2021, Operations will supplement the Open Access Transmission Tariff provisions by developing business practices outlining implementation aspects of its EIM participation. In April 2021, Operations worked with regional staff and customer groups to evolve transmission loss settlements for the CVP and COTP from physical to financial settlement coincident with going live with the EIM. Losses for COTP transmission service that is utilized in the CAISO markets are being resolved through an interim agreement with CAISO and the Transmission Agency of Northern California, until such time that CAISO can modify its tariff, which is expected to occur mid-2022.

In December 2021, SN supported modifications to the WAPA-wide OATT for FERC Order 845, dealing with Generator Interconnection Procedures and Agreements.

SN continues working with Reclamation in its pursuit of construction funding for the San Luis Transmission Project, a proposed 230-kV transmission line that will deliver Reclamation-generated hydropower to move water deliveries to agricultural and water users. SN will continue project coordination with other entities within the project corridor, including several solar developers and a large reservoir project.

SN partnered with the City of Roseville to aid in the installation of two generators owned by the California Department of Water Resources under an emergency declaration by the Governor of California. These are for emergency use only due to California drought conditions and were installed on the City of Roseville's system.

SN's partnership with the Department of Energy's Lawrence Livermore National Laboratory to provide new 115-kV service for LLNL's project to modernize its Exascale Computing Facility is continuing. SN continues to work with LLNL's contractor in the design, construction, commissioning, operation and maintenance support of the new 115/13.8-kV substation. Project energization is scheduled for early 2022.

SN continues to work with the U.S. Air Force for the proposed Beale Air Force Base Interconnection Project. The project includes a 230-kV transmission line and 230/60-kV substation that will provide Beale Air Force Base with access to reliable energy sources and help bolster security and resilience.

SN developed a 20-Plus-Year Capital Replacement Plan in coordination with the Transmission Agency of Northern California for the 500-kV COTP, which includes a comprehensive list of projects along with schedule and budget estimates for equipment upgrades on the COTP. The program will span more than 20 years and includes the design, procurement and installation of equipment reaching end-of-life cycle.

Completed and active projects include the Tracy Substation station service upgrade placed into service last summer and the COTP steel repair project completed by WAPA crews in 2021. 500-kV circuit breaker replacement projects are ongoing, and a major effort is underway to replace the series capacitor banks at Maxwell, Tracy and Olinda substations.

UPPER GREAT PLAINS

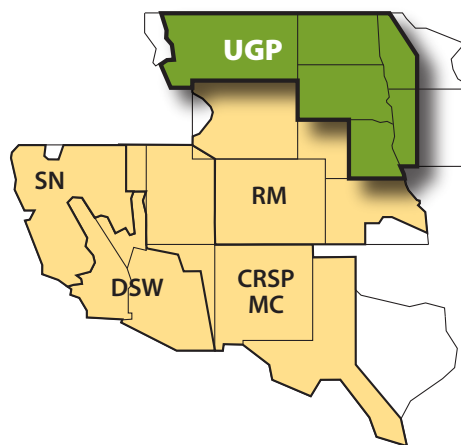
Upper Great Plains markets more than 9 million megawatt-hours generated at eight dams and powerplants in the Pick-Sloan Missouri Basin Program—Eastern Division to around 340 power customers in Montana, North Dakota, South Dakota, Nebraska, Iowa and Minnesota.

UGP delivers enough hydropower to serve more than 3 million households through 129 substations with 118 transformers and across 7,922 miles of federal transmission lines in its 378,000-square-mile service territory.

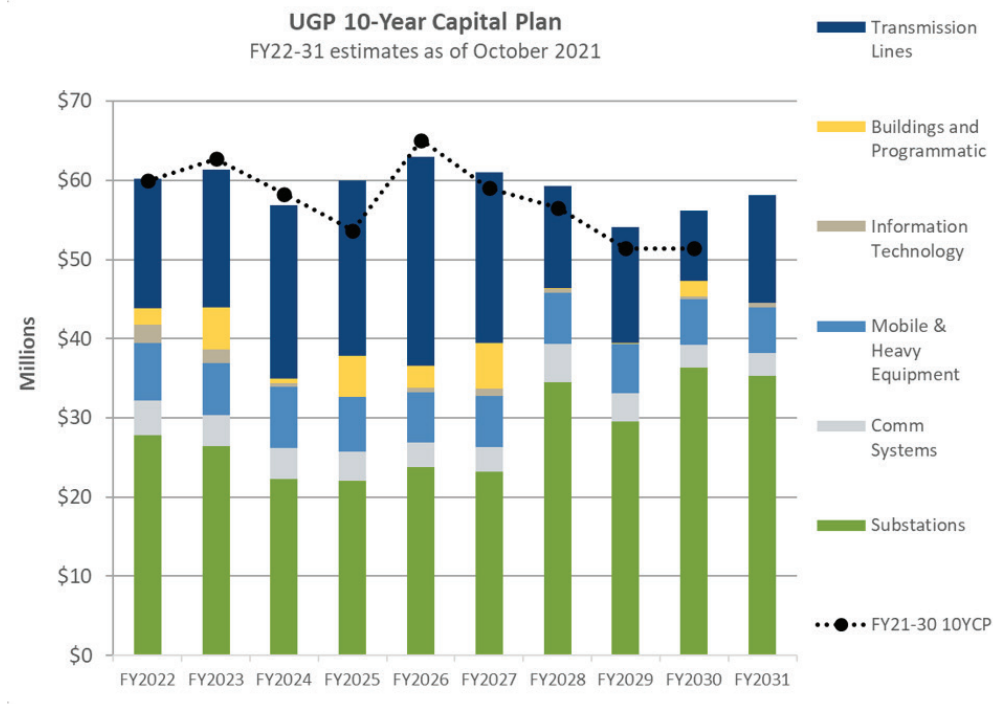
In 2021, eight significant construction projects were completed while 19 projects were in progress and 12 were in the planning stages.

Infrastructure projects completed in 2021 include:

- **Beresford Substation, Stage 10:** Request from the City of Beresford, South Dakota, to provide another 115-kilovolt line terminal. This addition required a new circuit breaker, disconnect switches, current transformers, a coupling capacitor voltage transformer and a new control panel in the control building. The new 115-kV terminal was energized June 3.
- **Jamestown Substation, Stage 14 (Phase A: control building and 115-kv control boards and Phase B: 230-kV control boards):** Replacing all control boards and the control building. The construction contract was completed June 2017. The North Dakota Maintenance Office started replacing all control cables to the 115-kV yard in July 2017 and completed the cutover in August 2018. Control cable replacements and cutover in the 230-kV yard started in May 2019 and is in tangent with four 230-kV breaker replacements. Final cutover of last panel was completed June 25.
- **Martin Substation, Stage 07:** Replacement of the 115/69-kV transformer, the majority of the 115-kV equipment and the station service. Existing drainage issues and the fence line that includes the building will also be addressed. Equipment including breakers, control panels and disconnect switches were purchased in 2019. The outage request to replace the equipment was delayed to June 2020 due to pre-scheduled outages in the area and then until April 2021 due to the pandemic. A shoo-fly was installed April 7 to tie the Philip and Mission lines together during the outage starting April 5. Work was completed and the station returned to service on July 8.
- **Miles City 2 Substation, Stage 03:** Installation of a new 115-kV breaker bay for new Montana-Dakota Utilities interconnection. In addition, a 10-megavolt ampere of reactive power capacitor bank was also installed. The work included grading, surfacing, conduit, grounding and the installation of a 115-kV breaker, a take-off structure, three 115-kV disconnect switches, three 115-kV potential transformers, three 115-kV current transformers, steel and associated bus and control and protection equipment. It was energized and placed into service April 4.
- **Shelby Substation, Stage 05, Control Building:** Replacement of the control building, control panels, station service and associated equipment. In conjunction with this work, Marias River Electric Cooperative requested that WAPA install metering current transformers and a meter in Shelby Substation. Marias wishes to connect after their irrigation load subsides. The 34.5-kV equipment was cut over June 15-16. The building and 115-kV equipment were cut over June 29-30.
- **Sioux City Substation, 230-kV Bus Upgrades:** Replacement of the 230-kV main and transfer bus towers and conductor to increase capacity due to wind farm additions in the Midcontinent Independent System Operator. Replacement of the transfer bus was completed in July 2018. South Dakota Maintenance Office crews installed two transmission line lift structures in April 2019 due to clearance issues over the new bus. The north main bus and the sectionalizing breaker were replaced in May 2019. The project was completed April 7.
- **East River Electric Substation additions:** WAPA allowed East River Electric to construct two new 115-kV substations on existing WAPA transmission lines: Hughes County Substation on the Pierre-to-Oahe 115-kV line section and Brown County Substation



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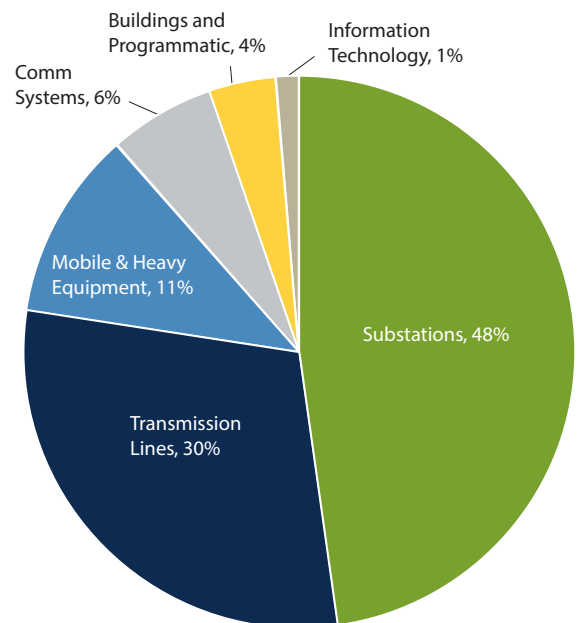
on the Ordway-to-Edgeley 115-kV line section. Work included approach spans, communications and relaying additions.

Upcoming projects that are currently in the design or construction phase include:

- **Creston-Maryville 161-kV reconductor:** Reconductoring with a larger conductor, replacing eight structures with dead-end structures and completing necessary maintenance replacements of entire structures or crossarms.
- **Devils Lake Stage 06:** Replacing the 115-kV main and transfer yard within a new yard expansion. The work will also include replacing the 115-41.8-kV transformer, a bank of 41.8-kV shunt capacitors, the control building, control panels and communication equipment. A second 115-kV capacitor bank will also be added.
- **Killdeer-Charlie Creek 115-kV rebuild:** Replacing the transmission line within the existing right of way with larger conductor and taller structures.
- **East River bay additions:** 69-kV bay additions are in progress at Summit, Brookings, Flandreau and Carpenter substations with early 2022 in-service dates.

Upcoming projects that were highlighted in WAPA's 10-Year Capital Plan include:

- **Halliday-to-Killdeer 115-kV rebuild:** The project includes replacing the transmission line within the existing right of way with larger conductor and taller structures.
- **UGP transformer replacements:** Transformers at Fort Thompson, Maurine, Sioux City and Watford City



substations are currently in the design and procurement phase.

- **Groton Substation:** Replacement of control building, control panels, grading and transformer.
- **Eagle Butte Substation:** Replacement of control building, control panels and grading, converting the bus to a ring configuration and reactor addition.

UGP has five significant projects supporting renewable generation interconnection, which continue to move forward for a total of 728 megawatts of capacity. These are located at the Campbell County, Valley City and New Underwood substations and two new switching stations.



Summarizing 2021 hydrology conditions

Editor's note: The following report summarizes data from WAPA's Hydropower Conditions webpage for straight power purchase costs, which are based solely upon hydrology, actual hydropower generation and related generation shortages. Readers may review all data by visiting wapa.gov, **Power Marketing, Hydropower Conditions**

One of the biggest challenges for hydropower is water variability due to intermittent drought and flooding. By definition, hydropower needs water to generate electricity. Without it, WAPA must buy power on the open market from other sources to meet contractual obligations to its customers. This is referred to as purchased power.

In an ideal year, snowpack around the West is average or above average, yielding snowmelt runoff to recharge reservoirs behind the dams and powerplants that provide the power WAPA markets. Federal dam owners such as the Bureau of Reclamation, the Army Corps of Engineers and the International Boundary and Water Commission move water to federal hydroelectric powerplants.

WAPA markets the subsequent power generated to around 700 preference customers. Its customers, in turn, sell that power to more than 40 million Americans.

Water around WAPA in 2021

WAPA's actual generation was 80% of average in water year 2021, for a total generation of 21,916 gigawatt-hours. For the same period, total purchased power was 3,976 GWh with actual purchase power expenses of \$250,236,417

equating to \$62.93 per megawatt-hour.

The Colorado River Storage Project Management Center projected most probable purchase power expenses for water year 2021 to be \$57,140,561. Actual purchase power expenses were a bit lower, at \$50,722,378. The cost per MWh was \$41.07.

Lake Powell ended the water year with an elevation of about 3,545 feet, or 155 feet from maximum reservoir level and 55 feet from the minimum generation level. The storage volume for Lake Powell was 7.3 million acre-feet at the end of September, or about 30% of capacity.

Extreme drought throughout the Colorado River Basin has resulted in about 181,000 acre-feet of additional water being released from Upper Colorado River Basin reservoirs to try to maintain Lake Powell elevation above 3,525 feet. However, even with additional releases from upstream reservoirs, Lake Powell is expected to drop below 3,525 feet. Consequently, additional releases from these reservoirs are being considered.

Desert Southwest's hydrology is mostly dependent on the Colorado River Basin snowpack and precipitation above Lake Powell. The region's most probable projected purchase power expenses were \$31,965,259. Actual purchase power expenses were lower, at \$25,518,630, with a cost per MWh of \$100.43.

Lake Mead elevation at the end of September was around 1,068 feet, or about 117.8 feet above the minimum generation elevation for Hoover Dam. The total side inflow into Lake Mead for water year 2021 was 593,000 acre-feet, which represents a 31% decrease from the previous year

NET GENERATION

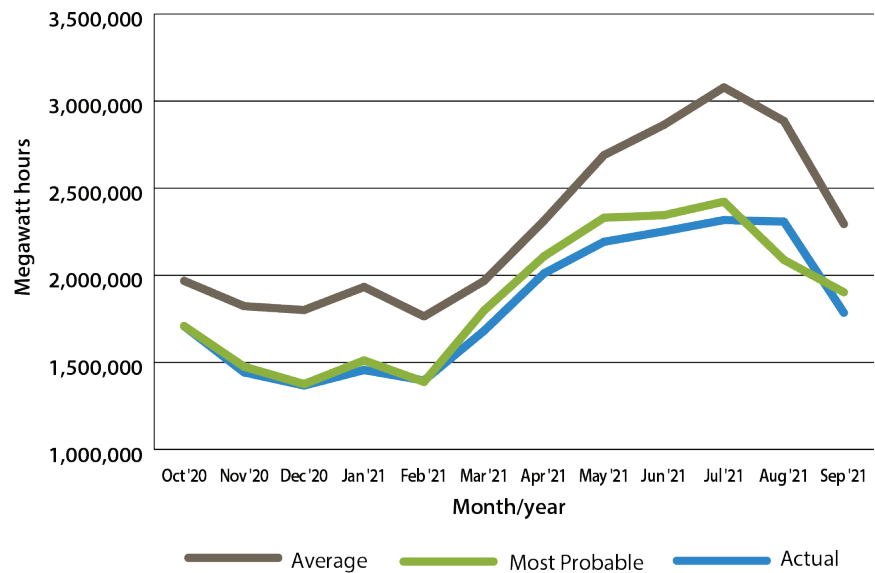
21,916

gigawatt-hours

80%

of average

Water Year 2021 Hydropower Generation Average vs. Most probable vs. Actual



and 46% of the normal annual side inflow.

Aggregate system storage for the Lower Colorado River Basin, or Lakes Mead, Mohave and Havasu, was 11.2 million acre-feet at the end of September, or 39% of the Lower Basin capacity.

In Rocky Mountain, at the end of September, reservoir inflows were 67% of average and reservoir storage was 99% of average. The most probable projected purchase power expenses were \$13,382,848, but actual purchase power expenses were notably higher at \$23,247,676. The cost per MWh was \$39.26.

Sierra Nevada ended the water year with 54% of the 15-year average reservoir storage for Trinity, 47% for Shasta, 53% for Folsom and 66% for New Melones. Accumulated inflow for the same date was 32% of the 15-year average for Trinity, 52% for Shasta, 35% for Folsom and 36% for New Melones. The region began water year 2021 with a most probable projection of purchase power of \$6,009,783 but ended with a significantly higher actual expense of \$18,846,261. The cost per MWh was \$31.48.

In Upper Great Plains, extreme drought conditions are occurring in most of North Dakota, northwest South Dakota and northeastern Montana, with some exceptional drought conditions in northcentral Montana and North Dakota. Severe and moderate drought as well as abnormally dry conditions are present in much of the lower half of South Dakota.

The yearly runoff forecast for the Missouri River basin as of Nov. 1 was 15.4 million acre-feet, or 58% of average. Runoff above Sioux City for October was .92 MAF, or 75% of average. System storage as of Nov. 23 was 43.4 MAF.

The region's most probable projection for purchase power was \$23,562,864. Actual purchase power expenses were \$131,901,472. The cost per MWh was \$101.75.

Average purchase power amounts and prices for the year were skewed by the extreme pricing and increased purchasing during the polar vortex on Feb. 15-16, with UGP significantly exceeding its purchase power estimates for the year in only February.

Anticipating water year 2022

The Seasonal Drought Outlook provided by the National Weather Service's Climate Prediction Center in November 2021 predicted persistent drought throughout the western United States. Additional significant drought development is also predicted in states such as Arizona, Colorado, Kansas, New Mexico, Oklahoma and Texas.

The predictions show drought conditions improving in the northwest, such as in Idaho, Oregon, Washington and Wyoming.

The NWS emphasized that its predictions are made in accordance with large-scale trends, which are based on "subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts." They emphasize caution and regular checking of updated drought predictions.

For more information...

Visit the National Weather Service's Climate Prediction Center at cpc.ncep.noaa.gov



STATE OF
WAPA's
ASSETS WINTER
2022

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